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CENTRAL INTELLIGENCE AGENCY

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COUNTRY Communist China

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SOURCE:

Available in Graphics Register are photographs and a related article on the cement industry in Communist China.

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Following is a list of the photographs and an unedited translation of the accompanying text:

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Photographs

CIA 457779	Yao-hsien Cement Plant in Shensi Province
CIA 848818	Kiln shop at Hua-hsin Cement Plant, Huang-shih City
CIA 868300	Rotary kilns at Ta-tung Cement Plant, Shan-hsi Province
CIA 876581	Chiang-nan Cement Plant, Nanking
CIA 876582	"Wu-yang-pai" cement storage at Chiang-nan Cement Plant
CIA 1026963	Peiping Concrete Pre-fab Plant
CIA 1057752	Kuang-chou Cement Plant
CIA 1062559	Limestone mine of Peiping Lin-li-ho Cement Plant
CIA 1071791	Sinkiang Cement Plant at Wu-lu-mu-chi
CIA 1150553	Lhasa Cement Plant

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CHINA'S GROWING CEMENT INDUSTRY

China will enter into the third five-year plan in 1966, and this is the year of preparation. While the contents and scale of the third five-year plan have not been announced, in view of the rising new production construction since the improvement of the national economy, that the scale of the capital construction in the new plan will exceed the first and second five-year plans can be easily deduced.

To promote a large scale capital construction, tremendous volumes of construction material, including cement, will become necessary. In March of this year, the Chinese government re-installed the State Construction Commission, and separated the Ministry of Construction Material Industry from the Ministry of Construction and made it into an independent agency, indicating a measure to assure the supply of construction material, including cement, for the smooth performance of the capital construction called for in the third five-year plan to begin next year. Here, let us examine the cement industry.

The Construction of Plants and Mines

China's rich reserve of limestone and clay, the principal raw material for cement, constitutes a favorable factor for the development of the cement industry. In the time of the Old China, not more than half of the provinces in the country possessed cement plants. After the founding of the New China, besides restoring and expanding the existing plants, many large, medium, and small plants have been built. At present, all provinces, municipalities, and autonomous regions have a cement industry, satisfying the need of the construction enterprise.

In the first five-year plan (1953-1957), besides the 10 plants above the standard investment (6 million yuan for the cement industry), many medium and small plants below the standard investment were being built. The annual output capacity in the five years grew to 2.61 million t. During the second five-year plan, the construction of the 10 plants, including the 3 large plants (Szechwan, Shensi, and Honan) under construction, were advanced. Plants with a total annual output capacity of 830,000 t¹ were completed in 1958; 5 plants (2 of them with an annual output capacity of 1 million t) were completed in 1958 [sic], and operation began. During the period of readjust-

Provinces

ment between 1960 and 1962, construction was curtailed. Since 1963, with the improvement of the national economy, besides resuming the temporarily suspended construction, new establishments and expansions are being promoted.

The newly established cement plants in recent years include more than 10 large and medium modern plants with annual capacities between 200,000 and 700,000 t and around 80 small ones with annual capacities below 100,000 t in Shansi's Ta-t'ung, Yunnan's Kunming, Shensi's Yao hsien, Kansu's Yung-teng, etc. (China News Press, 21 February 1965).

Concerning the construction of cement works up to 1962, please refer to a Conspectus of China's Industry and Trade published by this firm. Here, we will look at the condition of construction in 1963.

In 1963, besides completing a number of the new cement works started in the past several years and attaining the planned production capacity, limestone mines were constructed for the purpose of utilizing the latent power of the facilities of the existing plants. For example, the ores produced at the K'ung-shan Limestone Mines, the largest cement raw material mines in China newly established in the vicinity of Nanking, is of superior quality, and can supply the Chung-kuo Cement Plant and the Chiang-nan Cement Plant for 50 years. In addition, limestone mines have been newly set up at some large plants such as the Hua-hsin Cement Plant in Hupeh's Huang-shih municipality, Ch'i-hsin Cement Plant in Hopeh's T'ang-shan, etc.

The Dairen Cement Plant completed a large rotary kiln by its own effort in 1963.

The Canton Cement Plant completed the No. 4 rotary kiln (annual capacity 140,000 t) in May of 1963. It officially started operation in December of the same year. The output went up 50% all at once. This No. 4 kiln is 125 m long and 3 m in diameter, and all parts were produced domestically.

In 1964, the Nan-p'ing Cement Plant (Fukien) added 2 sets of cement equipment made in Fukien (annual capacity over 30,000 t).

The Lhasa Cement Plant (annual capacity 32,000 t) was completed in 1963, furnished with domestic automated equipment.

The Mao chia-chai Cement Plant (Tsinghai), the first modern plant in Tsinghai built near Ta-t'ung hsien's Ch'iao-t'ou-chen, was begun in 1963 and completed in May 1964. Its production process is almost entirely mechanized. With its completion, it will be able to satisfy the farmland and water conservation construction needs of the province.

In answer to the growing need of cement for farmland and water conservation projects in Hopeh, the remodelling of the 6 small plants in Hopeh's T'ang-shan, Huo-lo, Ch'in-huang-tao, Hsuan-hua, and Tientsin was completed in 1964. The total annual capacity is 260,000 t.

In April 1964 in Hupeh, the remodelling and expansion of the 3 plants in Wuhan, I-ch'ang, and O-ch'eng were started, to be completed in the third quarter (scheduled). With the remodelling, it will become possible to have an annual production increase of 100,000 t. In 1964, the cement required for the water conservation construction of the province was 1/3 higher than 1963. In addition, its industrial capital construction projects also increased. Therefore, the cement output had to be increased by remodelling and expansion.

Kwangtung is planning to establish or expand 12 vertical-kiln cement plants (workshops) this year. The vertical-kiln cement production of the province began in 1958. The 1964 output was 14.7 times that of 1958. The vertical-kiln cement is used for water conservation projects. The amount used for such projects in the province was over 280,000 t in the 4 years between 1961 and 1964.

With the improvement of the designing technology and the rapid development of the machine industry, China is able to design all types of cement plants. The entire equipment of large cement plants and mines, from the beginning of construction to operation, are supplied domestically. The machine equipment of K'ung-shan Limestone Mines, the largest cement raw material mines in China discussed above, was supplied domestically. Besides supplying the domestic need, cement plants are exported to Cambodia and other Asian and African countries.

The Growing Output

With the capital constructions discussed above, the cement output, as shown in the following chart, rapidly advances with the years. In the first five-year plan, the 1957 goal was set at 6 million t, but actually the annual average rate of growth was 19.1%, and the actual output was 6.86 million t. In the second five-year plan, the 1962 goal was set at 12.5 million t to 14.5 million t, but the 1959 output reached 12.27 million t, surpassing the goal 3 years in advance. The 1960 output was 16 million t. As the plans and results from 1961 on have not been published, the figures are unavailable, but a rapid rate of growth from 1963 on is indicated. For example, on 10 November 1963, the yearly plan was realized, and the output from January to October was 24% greater than the same period in 1962; 1964 was 20% higher than 1963. The increase in the first quarter this year was considerably great (New China Press wire, 30 April). For example, compared with the same period last year, the output of the Kwangsi Chuang Autonomous Region was more than 5 times greater, and that of Fukien, Kwangtung, and Chekiang all showed great increases, surpassing the level of the previous year.

Yearly Cement Output

(Unit: 10,000 t)

<u>Year</u>	<u>Output</u>
Peak in the Old China period	229
1949	66
1950	141
1951	249
1952	286
1953	388
1954	460
1955	450
1956	639
1957	686
1958	930
1959	1,227
1960	1,600
1961	-
1962	-
1963	24% or more greater than the previous year
1964	20% or more greater

Thus, besides domestic needs, a part of the output is exported. While the amount is not clear, the export to Hongkong is as follows.

(Unit: 10,000 yuan)

<u>Year</u>	<u>Amount</u>
1960	2,196
1963	3,840
1964, Jan.-July	2,548

The export of January-July 1964 was over 5 million yuan more than the same period of 1963, and greater than the yearly export of 1960. Among the 1 to 2 million t of cement (estimated) to be sold in Hongkong in 1964, it is estimated that 50,000 to 60,000 t will be China's "Wu-yang Brand" cement (Economic Guide, 2 November 1964).

Greater Varieties and Higher Quality

In 1949 when the New China was first established, there were only 3 varieties of cement. Now, in addition to ordinary cement, there are more than 20 new varieties, such as the decorating white cement, bridge pier cement, dam cement for dams, oil well cement for the petroleum industry, acid resistant cement, expansion cement,

Portland cement, alumina cement, silica cement, etc. The grades have also increased from 1 to 7 or 8. In the Old China period, only products of No. 300 and below were made, but between January and September 1962, the average number of products shipped out of the 12 large and medium cement plants in the country was 461. Currently, the clinker strength of the cement produced in most of the large and medium plants has reached No. 600 or better. The average number of cement was 473 in 1963, and 474 in the first quarter of 1964. In addition, the up-to-standard rate of products shipped out of factory was 99.8% in 1963, and 99.999% in the first quarter of 1964 (Worker's Daily, 7 May 1964).

For the purpose of improving the quality, besides improving the quality of clinker, the quality of raw material and fuel is strictly controlled in the plants, the contents of the raw material and fuel for the various processes homogenized, and the technical conditions standardized. For the purpose of improving the quality of limestone which constitutes around 80% of the clinker manufacturing raw material, the technical reform of limestone mines is being promoted, and their mechanization and semi-mechanization levels raised (*Ibid.*).

The quality of the "Wu-yang Brand" cement exported to Hongkong is superior to the Portland cement made in England.

English Made "Wu-yang Brand"

Solidification time (hours)	1.5 - 12	1.5 - 3
Pressure resistance (1 cm ² .lb)	5,000	6,000

The expansion strength of the "Wu-yang Brand" cement is also superior to the English product. It shows a silvery white color (Economic Guide, 2 January 1964).

Scientific and Technical Research, and Products Expansion

In the production of cement, China utilizes the new scientific and technical results. Electronic microscopes, X-rays, photoelectric color determination, etc., are being widely used. Besides pursuing an extensive scientific research, the China Silicate Society is organizing scientific research structures for cement products in construction work, railway, coal, petroleum, power, and communication

units and many provinces and municipalities, and forming a cement products scientific research force. In addition, special courses on cement and cement products are given in 5 industrial universities and technical schools in order to cultivate specialists.

The success of the new technical experiment to make alumina cement by the rotary kiln sinter process is one of the achievements in cement production technology in China. This new technology is the result of the experiments conducted by the researchers of the Building Material Scientific Research Institute. Compared with the old method, the new process reduces the consumption of coal and power and lowers the production cost by 1/3.

The alumina cement, also called the high alumina cement, has the special characteristics of quick hardening and fire resistance, and is needed by many industrial departments. Currently, the various countries in the world generally produce the alumina cement by the fusion process, whereby the raw material mixture is placed in a blast furnace, electric furnace, reverberating furnace, or rotary kiln and baked. After cooling, the mixture is powderized and made into cement. As the fusion raw material requires a rather high temperature, the fuel and power consumption is great, about .7t of coke per ton, or over 1,000 KWH of power. The cost is about 4 times that of ordinary cement.

The process discovered by the Chinese researchers is extremely simple. Limestone and alumina are powderized, then mixed according to a specific ratio, sintered in a rotary kiln used for making ordinary cement, and again pulverized. The temperature required for sintering is low and the fuel consumption small, not more than 250 Kg of coal per ton produced. The equipment of the existing cement plants can be utilized for this new process, and it is unnecessary to establish separate plants or borrow from the production capacity of the metallurgical industry. Furthermore, rich reserves of the raw material needed under the new process exist in China.

To make cement by the rotary kiln sintering process has been under study internationally for 40 years. As the control of the sintering temperature is difficult, it is not yet introduced for regular industrial use. The Chinese researchers collected more than 20 kinds of raw material, performed tests many times, found the proper raw material combination, and solved the difficult problems in sintering. The alumina cement produced by this new technology is already being supplied to metallurgical, chemical industrial, hydroelectric, and other departments. It is reported that the users have found the quality satisfactory (New China Press, 13 November 1964).

China's cement products scientific research work has been developing rapidly since 1958. In July of 1963, the China Silicate Society held the first cement products academic conference in Wuhan. At the conference, it was ascertained that dozens of cement products had been studied and successfully trial manufactured, including re-

enforced concrete railway ties, pit braces, cement boats, machine platforms, all types of concrete pipes, prefabricated construction materials, etc., and that most of them were being mass produced.

The cement products of the country in 1962 totalled 320,000 m³, which played an important part in supporting industry and agriculture and saving steel.

Cement products for rural use include farm boats, telephone poles, floodgates, grape vine trellises, asbestos cement tiles, prefabricated construction materials, etc., and they are being rapidly promoted for popular use. For example, since the trial manufacturing of the cement farm boat in 1961, it has been continually improved, and the hull is becoming better and better. In regard to its weight, a one-ton load requires about 1,000 Kg of empty weight, a reduction of 500 - 700 Kg. The cost is approaching that of the wooden boat. According to preliminary statistics, by April 1963, farm boats under 5 t numbered over 2,500, and a total of more than 5,000 t was manufactured (New China Press, 27 June 1963).

In some of the rural villages in Kiangsu and Chekiang, precast concrete houses are appearing. Kiangsu's rural villages have built over 3,500 pre-cast concrete houses, about 60,000 m³. The industrial units of Kiangsu began mass production of concrete panels for the rural village in 1962. A 2-room house of 42 m³ is 30% cheaper than wooden houses, and popular with the farmers (China News Press, 28 February 1965).

Much has been achieved in enhancing the quality of cement products, reducing the weight, and improving the production technology. A systematic study was carried out to solve the problem of the crack in attachments to cement products, and the nature, special characteristics, danger, and cause of the crack were ascertained. In addition, the study of steaming, vibrating pressure moulding, bent board moulding, and framework moulding has produced many results, and some of them have been effective in practical production.

Furthermore, much research is done on the function, raw material composition, rust resistance, and corrosion resistance of cement products, as well as the mechanization of the production pattern, and considerable scientific data have been accumulated for the improvement of the production efficiency and quality (New China Press, 7 July 1963).

Principal Cement Plants

- (1) Liu-jui-ho Cement Plant (Peiping). The mechanization of the limestone mines of this plant is advancing. From August 1960 to now, 80% of the excavation and transporting has been mechanized.
- (2) Ta-t'ung Cement Plant (Shansi). An automated plant built with the aid of East Germany; completed in December 1956.
- (3) Honan Cement Plant
- (4) Dairen Cement Plant. A large rotary kiln was completed by its own effort in 1963.
- (5) Pen-ch'i Cement Plant (Liaoning)
- (6) Chin-hsi Cement Plant (Liaoning)
- (7) T'ang-shan Ch'i-hsin Cement Plant (Hopeh). A new limestone mine was established in 1963.
- (8) Yao-hsien Cement Plant (Shensi). A modern plant built with the aid of East Germany; trial production began in November 1959; producing mainly No. 500 silica cement.
- (9) Yung-teng Cement Plant (Kansu). The 1963 production plan was 20% greater than the 1962 actual output; the 1964 production plan was 29% greater than the 1963 plan (prospective).
- (10) Chungking Cement Plant. A modern plant built with the aid of East Germany. The 1962 output was 25.5% higher than 1961; the 1963 production plan was completed in the middle of November in advance.
- (11) Nanking Chiang-nan Cement Plant. A plant with 40 years of history; a vertical furnace with an annual capacity of 32,000 t was installed in 1958; technical reform was carried out of the 4-motor revolving furnace for principal production in 1960, and the annual output capacity was increased by 75,000 t. Produces the "Wu-yang Brand" cement with raw material supplied by the K'ung-shan Limestone Mines, the largest limestone mines in China.
- (12) Chung-kuo Cement Plant
- (13) Huang-shih Municipality Hua-hsin Cement Plant. Actual output of 1958 was 660,000 t; planned output of 1959 was 900,000 t; actual output of 1962 was 9 times the output at the time of the liberation. Supplied by the Huang-chin-shan Limestone Mines (reserve over 100 million t) with limestone raw material containing 85% or more of calcium carbonate.
- (14) Shanghai Pai-se (White) Cement Plant. Produces "Parrot" brand white cement.
- (15) Canton Cement Plant. The No. 4 rotary kiln (annual output 140,000 t) was completed in May 1963, and production began in December of the same year. The output increased 50% all at once. The No. 4 kiln is 125 m in length and 3 m in diameter.

(16) Nan-p'ing Cement Plant (Fukien) 2 sets of production equipment (annual output over 30,000 t) made in Fukien were added in 1964.

(17) Wuhan Cement Plant. Expanded in 1964.

(18) I-ch'ang Cement Plant (Hupeh). Expanded in 1964.

(19) O-ch'eng Cement Plant (Hupeh). Expanded in 1964.

(20) Kweichow Cement Plant 2 rotary kilns plunged into production in 1959.

(21) Kunming Cement Plant

(22) Tsinan Cement Plant

(23) Chen-chiang Cement Plant

(24) Hsiao-t'un Cement Plant

(25) The Inner Mongolia Autonomous Region has modern plant(s) with annual output of 300,000 t, supplied by the Paotow Iron and Steel Corporation.

(26) Mao-chia-chai Cement Plant (Tsinghai). Begun in October 1963 and completed in May 1964; the first modern cement plant in Tsinghai.

(27) Lhasa Cement Plant Begun in 1960 and completed in 1963; annual production capacity 32,000 t; furnished with domestic automated equipment.